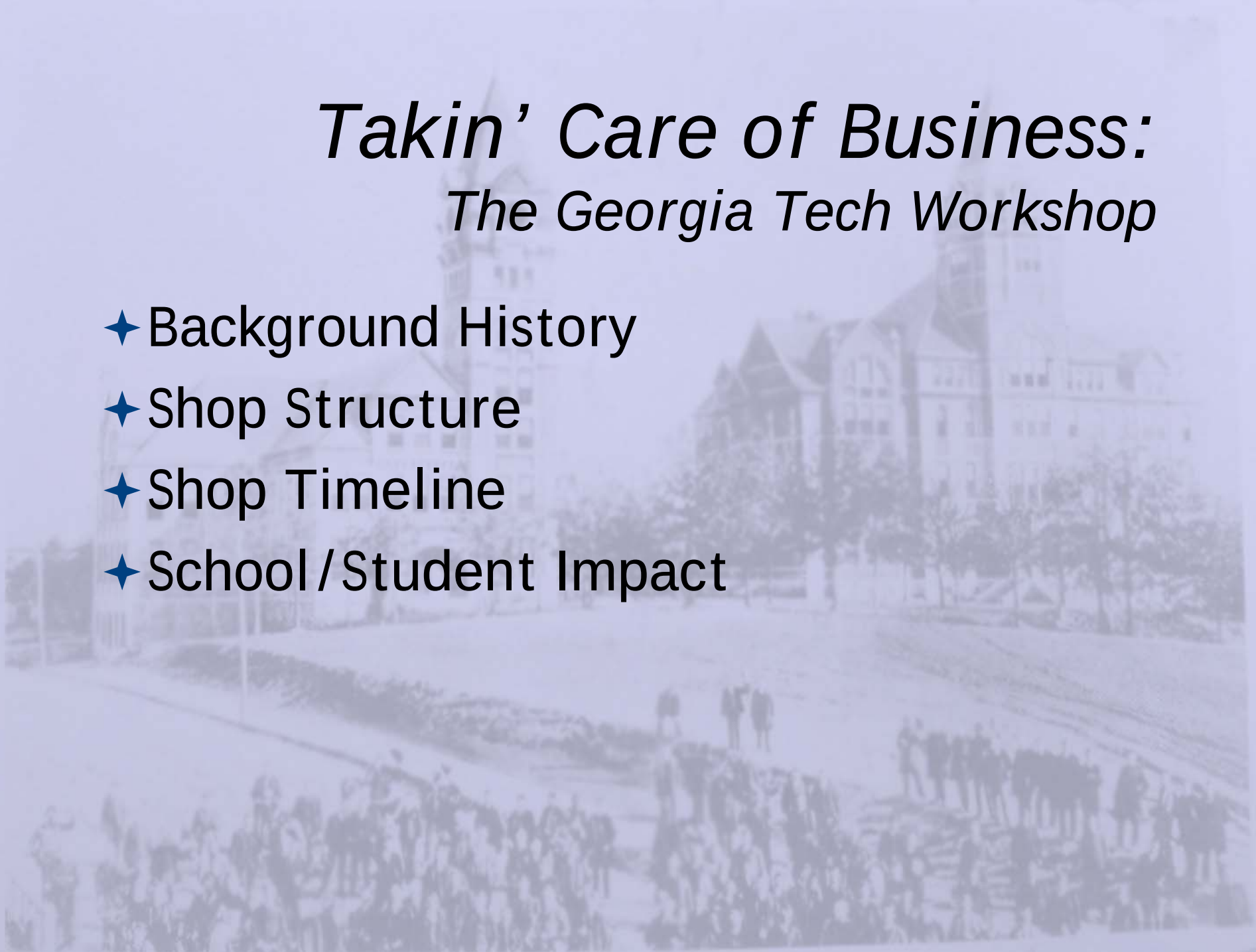
Takin' Care of Business:
The Georgia Tech Workshop

- Background History
- Shop Structure
- Shop Timeline
- School/Student Impact



Background History

- Britain rose to the top of industrialization through family connections and practical experience
- 1829- France develops a school called Ecole Centrale des Arts et Manufacturers. It provided a steady supply of graduates into industry
- Thomas Huxley pushed a science/industrial-based education
- Georgia Tech based on Worcester Institute

School and Shop Culture

- Two models of education: shop culture and school culture
- School culture opened mechanical engineering as a profession to the lower class and non-shop background
  - Robert H. Thurston- “designers of construction, not constructors”
  - More theoretical in nature
- Shop culture was for a class-conscience elite with family connections, like in Britain
  - More stress on practical shop work
  - Students were not prepared for mechanical research

Worcester Institute

- Founded in 1865 and opened in 1868.
- 3.5 year free program
- Students required to spend 2,376 hours in the shop
- Shop was commercial
  - The Washburn Shop
- Georgia Tech modeled after Worcester

Early Georgia Tech

- After the Civil War, the South was forced to pursue industrialization
- Georgia Tech founded in 1885, under the shop culture
- Tech recruited the head superintendent at Worcester, Milton P. Higgins, and George J. Alden, a mechanical engineering professor at Worcester
- They attended a meeting at Tech in 1886, and discussed the proper model of organization

Early Georgia Tech

- Newspapers in the North criticized us for copying Worcester's model
- Tech offered both Higgins and Alden jobs
- Part of the New South
  - The workshop was an embodiment of industrialization and heavily influenced the student body

Shop Structure

- At the school's opening(1888), it had two buildings - the Tech Tower and the Shop
- Shop was a two-story building, with a tower which was similar to the Tech Tower building
  - "Mind and Hand"
- First floor was metalworking, and included a drawing room, office, machine shop, engine room, blacksmith shop, iron foundry, and brass foundry.
- The second floor had a woodshop, and was state-of-the art. It had 32 work benches, 6 lathes, 6 jigsaws, a bandsaw, 3 planers, a tenon machine, and mortising machine

Class Structure

- Sub-Apprentice, Apprentice, Junior, Middle, and Senior classes
- Lower classes worked on woodworking
- Upper classes focused on ironwork(started with Junior class)
- Last three years were smith shop and foundry.

- “Bedroom suites, wardrobes, tables, easels, hat racks, cedar clothes chests, tool chests, mantels, bookcases, writing desks, etc., are made by them [apprentices] and will bear the very closest scrutiny”(Greene 93).

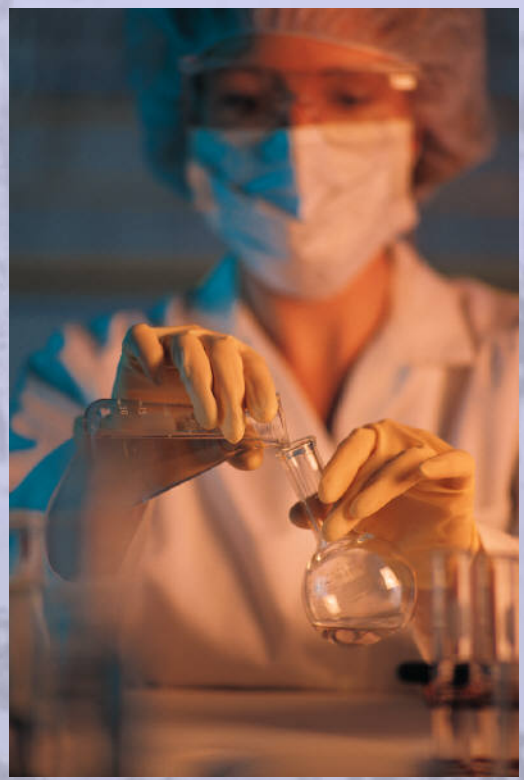
The Drawing Department

- According to *The Georgia Tech*, the drawing department was an essential part of the workshop
- Apprentice students were not allowed to use rulers for six months
- Juniors learned the principles of bisecting angles, and began to draw pentagons and hexagons
- Middle Year is when they got a chance to draw machines and their various parts
- The Seniors had the necessary experience to design their own machines

Question?

- Does a mechanical engineer at GT have the same dexterity today that they did during the time of the workshop?

Takin' Care of Business Experiment



Timeline of the Workshop

- Milton P. Higgins
- W.F. Cole
- G.E. Cassidy
- Workshop Fire
- Alfred Jessop
- Post-Commercial Workshop

Milton P. Higgins

- First year Tech had Milton P. Higgins for superintendent from Worcester
- He was getting paid a half salary for Worcester, because he was working for Georgia Tech and Worcester
- He had to leave after a year

W.F. Cole

- W. F. Cole, of the Washburn Shops(Worcester) was elected to come down to take over at Tech
- He stayed for a year, then went back to work as an assistant with Higgins
- Tech had no capital to work with
- The contractors had to pay immediately

G.E. Cassidy

- G.E. Cassidy became the superintendent after Cole left
- He was a woodshop foreman
- Transition to superintendents that were not as experienced
- This probably led to the shop's eventual failure

Workshop Fire

- Policeman spotted the fire and reported it
- North Ave. was muddy, so the fire trucks detoured to Simpson Street
- Estimated loss of $30,000, but insurance only covered $18,000
- Burnt down the majority of the building
- Three chest of tools were rescued by students

Fire cont..

- A large number of contract work was destroyed.
- Board of Trustees found a deficit for each month of work
- Largest reaching $2,555 in December

Alfred Jessop

- He worked in Southern Agricultural Works
- They manufactured plows and other agricultural equipment
- Located between Marietta Street and W & A Railroad
- Most likely recruited by Atlanta manufacturers on the Board of Trustees
- Jessop experienced even greater deficits, excluding his salary of $200 a month
- During his fifth year, he had an operating deficit 3.5 times that of Higgins
- The board was forced to shut the workshop down

ISAAC S. HOPKINS, Ph.D., D.D. President

OFFICE OF GEORGIA SCHOOL OF TECHNOLOGY

A. JESSOP Superintendent of Shops

TELEPHONE 341

GENERAL WOOD, FOUNDRY AND MACHINE WORK.

SHOPS

Atlanta, Ga. Oct. 7" 1895

Mr. John W. Hewatt
Green Bush Ga.

Dear Sir;

Yours of 3rd inst — I have not now plenty of shullers on hand as the demand has been so great. I have just about completed extra patterns now so I can turn out double the quantity per day and I expect to keep up with all orders.

Try to get your orders in so I can have a margin of 10 days to fill them in after receipt of order. I will try to ship earlier if I can if it be possible.

Yours Truly
A. Jessop

ISAAC S. HOPKINS, Ph.D., D.D. President

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A. JESSOP Superintendent of Shops

TELEPHONE 341

GENERAL WOOD, FOUNDRY AND MACHINE WORK.

SHOPS

Atlanta, Ga. Oct. 22" 1895

Mr. J. W. Hewatt
Green Bush Ga.

Dear Sir;

Your valued favor of 15th with 65.$ (Sixty Five Dollars) enclosed is at hand, with order for 65 Bbls of Ga. Corn Shullers to be shipped to Jasper Ga.

Please accept thanks for same. We expect to ship the shullers on Friday or Saturday — Friday if possible, but tomorrow being Presidential day at the Exposition we cannot get our men to work for love or money. We think we will get them off on Friday. Please give us more margin of time hereafter + oblige.

Yours Truly
Jessop + Buzzell

JESSOP & BUZZELL,
SUCCESSORS TO
Ga. School of Technology Shops,
ATLANTA, GA.

Post-Commercial Workshop

- 1896- Shop was changed from a commercial to purely educational endeavor
- 1896- Course catalog describes the contract system being abandoned not because of lack of efficiency, but instead because the demands of the contract system took away from education
- It was said that students could learn to do a "poor, cheap job, after graduation," where the "scramble for the mighty dollar may force it upon them."

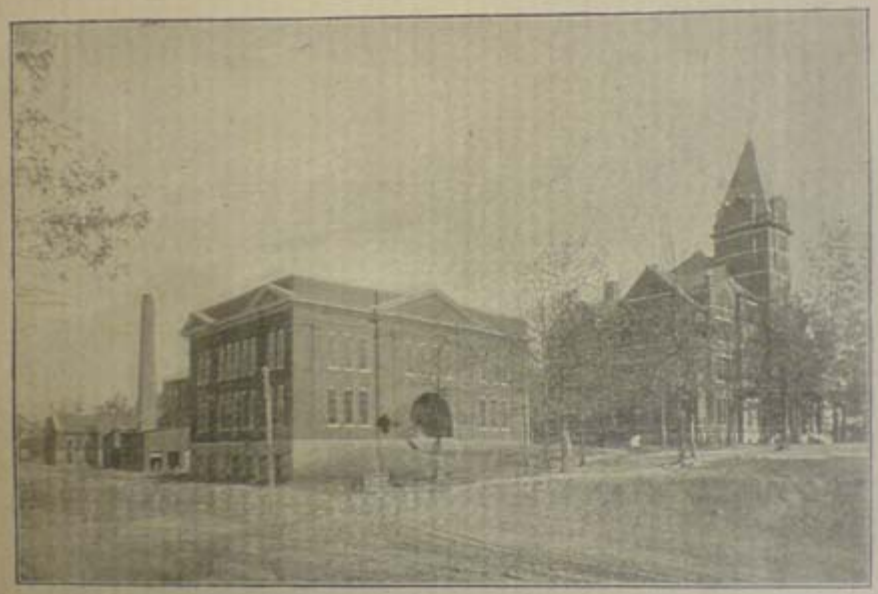
Post-Commercial Workshop

- Students were required to spend a lot of hours in the shop
  - Apprentice-16 hours
  - All other students-8 hours
- The catalog still advertised student work that was for sale(planers and wooden cases for large drawings)
- Georgia Tech emphasized practical skill and experience
- Does Tech still embody this philosophy of practical skill and experience?
- Could today's GT students implement a commercial shop system?

The Georgia Tech

- *The Georgia Tech* was a monthly student newspaper
- Student life was a focus of the newspaper
- “Localisms” and “Locals” sections contained accounts of visitors and student jokes, and portrayed student lifestyles
- It also reflected the focus on the workshop

THE GEORGIA TECH.



be taken in the matter.

Prep—"What man is that in the shop with red whiskers? He has an office, has he not?"

Senior—"He is an alumnus of class '91."

Prep—"Well, what office is that in the shops, please, and does it pay well?"

One of the editors wants the Faculty to give him an office in the attic of the college building so that his ideas may not be hampered for lack of elevation.

Question: "What's the difference between a draughtsman and a hen?"

Answer: "One hatches a cross section and the

from the usual exercises and cannot be properly considered a part of them. However we look forward to these exercises with unusual interest.

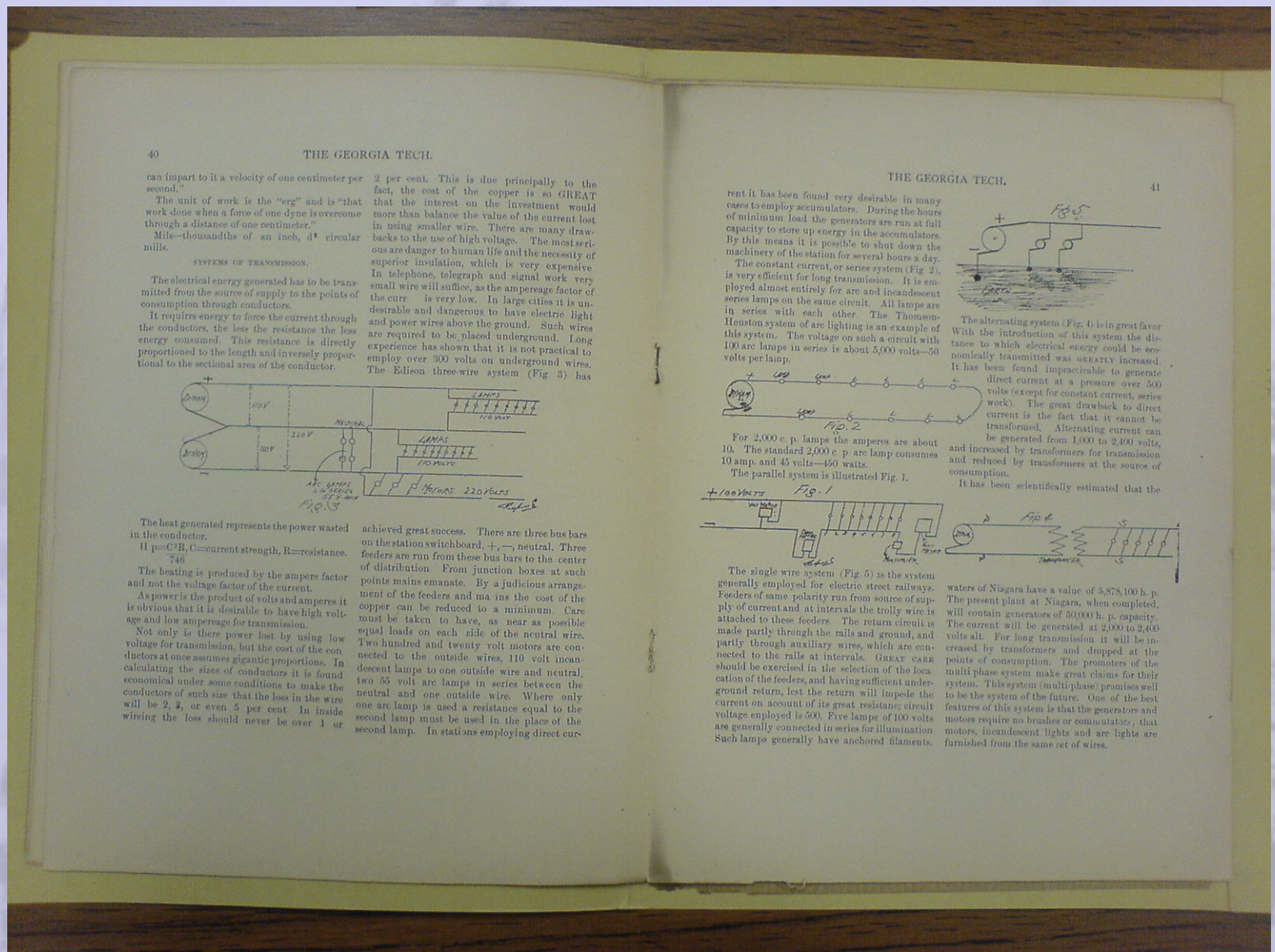
* * *

IT is interesting to know that some important tests have recently been made on the testing machine here, for the city. The tests were of some vitrified bricks which were being furnished the city for paving. The bricks were cut up into two-inch cubes and tested for compressive strength. The lowest test recorded was 6,500 pounds per square inch. The highests tests went beyond the limits of the machine, 50,000 pounds, or 12,500 pounds per square inch. The bricks averaged about 11,000 ponnds per square inch. There were only two which went below 10,000 pounds per square inch. The testing machine is the best in the city, and in perfect working order, a fact which adds value to the tests made by the students. It has recently been overhauled by some of the Senior Class.

* * *

IT affords us pleasure to mention through our columns the existence of the Southern Society of Mechanical Engineering, a society organized

- The Alumni Department wrote articles as well, which were scientific in nature



can impart to it a velocity of one centimeter per second."

The unit of work is the "erg" and is "that work done when a force of one dyne is overcome through a distance of one centimeter."

Mils—thousandths of an inch, d^2 circular mills.

SYSTEMS OF TRANSMISSION.

The electrical energy generated has to be transmitted from the source of supply to the points of consumption through conductors.

It requirrs energy to force the current through the conductors, the less the resistance the less energy consumed. This resistance is directly proportioned to the length and inversely proportional to the sectional area of the conductor.

Fig. 3

The heat generated represents the power wasted in the conductor.

H p=C^2R, C=current strength, R=resistance.
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The heating is produced by the ampere factor and not the voltage factor of the current.

As power is the product of volts and amperes it is obvious that it is desirable to have high voltage and low ampereage for transmission.

Not only is there power lost by using low voltage for transmission, but the cost of the conductors at once assumes gigantic proportions. In calculating the sizes of conductors it is found economical under some conditions to make the conductors of such size that the loss in the wire will be 2, 3, or even 5 per cent. In inside wireing the loss should never be over 1 or 2 per cent. This is due principally to the fact, the cost of the copper is so GREAT that the interest on the investment would more than balance the value of the current lost in using smaller wire. There are many drawbacks to the use of high voltage. The most serious are danger to human life and the necessity of superior insulation, which is very expensive. In telephone, telegraph and signal work very small wire will suffice, as the ampereage factor of the curr is very low. In large cities it is undesirable and dangerous to have electric light and power wires above the ground. Such wires are required to be placed underground. Long experience has shown that it is not practical to employ over 300 volts on underground wires. The Edison three-wire system (Fig 3) has achieved great success. There are three bus bars on the station switchboard, +, —, neutral. Three feeders are run from these bus bars to the center of distribution. From junction boxes at such points mains emanate. By a judicious arrangement of the feeders and ma ins the cost of the copper can be reduced to a minimum. Care must be taken to have, as near as possible equal loads on each side of the neutral wire. Two hundred and twenty volt motors are connected to the outside wires, 110 volt incandescent lamps to one outside wire and neutral, two 55 volt arc lamps in series between the neutral and one outside wire. Where only one arc lamp is used a resistance equal to the second lamp must be used in the place of the second lamp. In stations employing direct current it has been found very desirable in many cases to employ accumulators. During the hours of minimum load the generators are run at full capacity to store up energy in the accumulators. By this means it is possible to shut down the machinery of the station for several hours a day.

The constant current, or series system (Fig 2), is very efficient for long transmission. It is employed almost entirely for arc and incandescent series lamps on the same circuit. All lamps are in series with each other. The Thomson-Houston system of arc lighting is an example of this system. The voltage on such a circuit with 100 arc lamps in series is about 5,000 volts—50 volts per lamp.

Fig. 2

For 2,000 c. p. lamps the amperes are about 10. The standard 2,000 c. p. arc lamp consumes 10 amp. and 45 volts—450 watts.

The parallel system is illustrated Fig. 1.

The single wire system (Fig 5) is the system generally employed for electric street railways. Feeders of same polarity run from source of supply of current and at intervals the trolly wire is attached to these feeders. The return circuit is made partly through the rails and ground, and partly through auxiliary wires, which are connected to the rails at intervals. GREAT CARE should be exercised in the selection of the location of the feeders, and having sufficient underground return, lest the return will impede the current on account of its great resistance; circuit voltage employed is 500. Five lamps of 100 volts are generally connected in series for illumination. Such lamps generally have anchored filaments.

Fig. 5

The alternating system (Fig. 4) is in great favor. With the introduction of this system the distance to which electrical energy could be economically transmitted was GREATLY increased. It has been found impracticable to generate direct current at a pressure over 500 volts (except for constant current, series work). The great drawback to direct current is the fact that it cannot be transformed. Alternating current can be generated from 1,000 to 2,400 volts, and increased by transformers for transmission and reduced by transformers at the source of consumption.

It has been scientifically estimated that the

Fig. 4

waters of Niagara have a value of 5,878,100 h. p. The present plant at Niagara, when completed, will contain generators of 50,000 h. p. capacity. The current will be generated at 2,000 to 2,400 volts alt. For long transmission it will be increased by transformers and dropped at the points of consumption. The promoters of the multi phase system make great claims for their system. This system (multi-phase) promises well to be the system of the future. One of the best features of this system is that the generators and motors require no brushes or commutators; that motors, incandescent lights and arc lights are furnished from the same set of wires.

Rules of the Shop

- The workshop was based on a set of stringent rules
- Student was expelled for accusing a shop foreman of lying
- This was considered inappropriate

The Gymnasium

- According to *The Georgia Tech, the* gym was built by students, for students
- Tech used its own resources for this
- It received no funds
- Students who committed the most hours to shop work, were permitted to use the gymnasium
- This boosted production in the shop

be successful in his effort to form the association.

THE GYMNASIUM.

Work on the gymnasium is progressing quite rapidly, most of the dues coming in the form of work in the shops on the apparatus, instead of as cash; by this means we will likely have it equipped by the end of the year, which will be very gratifying to everybody concerned.

The most important piece of work completed last month was a pair of parallel bars made by Messrs. Daniels and Reynolds. These bars are of the most substantial pattern, having a cast-iron base and the upper frame-work of oak. There have been many smaller things made, such as travelling rings, dumb-bells, Indian-clubs etc.

There is one thing which we are very sorry to see in connection with the Gymnasium, that is, there are a few students who will not become members just because it requires a little more work in the shops to get a membership, although they use it as much or more than a large number of members. The only way to prevent the Gymnasium being used by this class of people is for the directors to make enough keys for every member to have one, and then keep the door always locked; if this does not secure the Gymnasium from intrusion from these outsiders, there will be no course left but to put iron gratings on the windows.

Advertisements

- *The Georgia Tech* demonstrates how the institute was advertised, not only as a school, but a business

Conclusion

- “For I hold very strongly by two convictions--The first is, that neither the discipline nor the subject-matter of classical education is of such direct value to the student of physical science as to justify the expenditure of valuable time upon either;and the second is, that for the purpose of attaining real culture, an exclusively scientific education is at least as effectual as an exclusively literary education.”(Huxley,228)

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